



Subject card

Subject name and code	, PG_00070845						
Field of study	Recycling and Energy Recovery						
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026				
Education level	first-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery	at the university				
Year of study	3	Language of instruction	Polish				
Semester of study	6	ECTS credits	5.0				
Learning profile	general academic profile	Assessment form	assessment				
Conducting unit	Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Justyna Płotka-Wasyłka					
	Teachers	dr hab. inż. Justyna Płotka-Wasyłka dr inż. Tomasz Dymerski dr hab. inż. Mariusz Marć prof. dr hab. inż. Agata Kot-Wasik prof. dr hab. inż. Andrzej Wasik dr hab. inż. Weronika Hewelt-Belka prof. dr hab. inż. Bożena Zabiegała dr inż. Wojciech Wojnowski					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	0.0	30.0	0.0	20.0	70
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM		
	Number of study hours	70	0.0	0.0	70		
Subject objectives	The objective of the course is to familiarize students with modern instrumental techniques used in environmental analysis, develop practical skills in sample preparation, instrument operation, and data interpretation, and foster the ability to critically evaluate data quality and select appropriate methods for assessing pollutants in air, water, and soil, and food samples.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W04] demonstrates knowledge and understanding of research methods (information acquisition, simulations, experimental methods) in the field of technologies related to the recovery of raw materials and energy.	The student is able to apply modern instrumental techniques in environmental analysis, independently acquire and interpret experimental data, and select appropriate analytical methods for the assessment of pollutants in air, water, and soil.	[SW3] Assessment of knowledge contained in written work and projects
	[K6_U02] solves engineering issues and problems in the area of raw materials and energy recovery through the use of appropriate analytical, numerical and experimental tools and methods.	The student is able to solve problems related to environmental pollution assessment using appropriate instrumental, experimental, and analytical methods.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
	[K6_U04] formulates research problems and selects appropriate research methods (information acquisition, simulations, experimental methods) in the field of technologies related to the recovery of raw materials and energy in order to solve specific tasks and to report research results.	The student is able to formulate analytical problems in environmental protection and select appropriate instrumental techniques and experimental methods to solve them and report the results.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
Subject contents	<p>Course content – lecture</p> <p>ECh Electrochemical Methods;</p> <p>MS Mass Spectrometry;</p> <p>TS Spectroscopic Techniques;</p> <p>TCh Chromatographic Techniques;</p> <p>ATM Remote Sensing and In-Situ Measurements in Atmospheric Studies;</p> <p>CE Capillary Electrophoresis;</p> <p>TM Microextraction Techniques</p>		
	<p>Course content – laboratory</p> <p>GC-MS Nicotine: Determination and identification of nicotine contaminants;</p> <p>HPLC Caffeine: Determination of caffeine in selected samples;</p> <p>GC-ECD PCB: Determination of persistent chlorinated pollutants in surface waters;</p> <p>GC-FID: Determination of tropospheric ozone precursors in ambient and indoor air;</p> <p>LC-MS Biopharmaceuticals: Analysis of pharmaceutical compound;</p> <p>HPLC-MS-MS: Determination of synthetic sweeteners;</p> <p>UFGC: Wine analysis and classification</p> <p>Course content – seminar</p> <p>Project work will be arranged with students during the classes.</p>		
Prerequisites and co-requisites	Basic knowledge of environmental protection and proficiency in computer use and spreadsheets. Basic knowledge of pollution analytics and general chemistry.		

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Exam	60.0%	50.0%
	Labs	60.0%	40.0%
	Seminars	60.0%	10.0%
Recommended reading	Basic literature	<p>Skoog, D. A., Holler, F. J., Crouch, S. R. <i>Principles of Instrumental Analysis</i>, 7th Edition, Cengage Learning, 2018.</p> <p>Kellner, R., Mermet, J. M., Otto, M., Widmer, H. M., Brenna, O. <i>Analytical Chemistry</i>, 2nd Edition, Wiley-VCH, 2004.</p> <p>Braun, R. D., Lichtenberg, J. J., <i>Environmental Analytical Chemistry</i>, Wiley, 2013.</p> <p>Gross, M. L., <i>Mass Spectrometry: A Textbook</i>, 3rd Edition, Springer, 2017.</p> <p>Poole, C. F., <i>The Essence of Chromatography</i>, 3rd Edition, Elsevier, 2012.</p> <p>Harris, D. C., <i>Analytical Chemistry for Environmental Scientists</i>, CRC Press, 2016.</p>	
	Supplementary literature	<p>Harris, D. C. <i>Quantitative Chemical Analysis</i>, 10th Edition, W. H. Freeman, 2015.</p> <p>Harris, D. C. <i>Exploring Chemical Analysis</i>, 5th Edition, W. H. Freeman, 2018.</p>	
	eResources addresses		

<p>Example issues/ example questions/ tasks being completed</p>	<p>Sample Topics:</p> <ol style="list-style-type: none"> 1. Electrochemical Methods in Environmental Analysis potential measurement, amperometry, voltammetry. 2. Mass Spectrometry (MS) principles, ionization, detectors, and applications in pollutant analysis. 3. Spectroscopic Techniques (TS) UV-Vis, IR, AAS, ICP-OES and their use in environmental chemical analysis. 4. Chromatographic Techniques (TCh) GC, HPLC, FID, ECD, LC-MS/MS for determination of organic and inorganic pollutants. 5. Remote Sensing and In-Situ Measurements in Atmospheric Studies (ATM) gas sensors, particulate matter and ozone measurements, air quality monitoring techniques. 6. Capillary Electrophoresis (CE) principles and applications in the analysis of ions and biological substances. 7. Microextraction Techniques (TM) SPE, SPME, liquid and gas microextraction, applications in environmental analysis. 8. Practical Aspects of GC-MS and HPLC Analysis determination of nicotine, caffeine, PCBs, and synthetic sweeteners in environmental and food samples. 9. Analysis of Biopharmaceuticals and Natural Compounds LC-MS and UFGC for quality assessment of products and drugs. 10. Optimization of Ultrasonic and Chromatographic Instrument Parameters frequency, power, amplitude, reactor geometry, and extraction condition optimization.
<p>Practical activities within the subject</p>	<p>Not applicable</p>

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